DOCUMENT RESUME

ED 472 967

SE 067 209

AUTHOR	Day, Robert; Beeth, Michael E.
TITLE	Development of Supplemental Instruction for Pre-Service K-8 Teachers Enrolled in a Non-Major Undergraduate Biology Class: A Golden Opportunity.
PUB DATE	2003-00-00
NOTE	12p.; Paper presented at the Annual Meeting of the Association for the Education of Teachers of Science (St. Louis, MO, January 29-February 2, 2003).
PUB TYPE	Reports - Descriptive (141) -- Speeches/Meeting Papers (150)
EDRS PRICE	EDRS Price MF01/PC01 Plus Postage.
DESCRIPTORS	Educational Change; Higher Education; *Inquiry; Nonmajors; Science Instruction; *Science Laboratories; Teacher Education

ABSTRACT

This paper introduces a course entitled "Teaching and Learning Life Science" which was developed as a direct response to a call for educational change in science teacher education. This course combines science content with laboratory experiences and pedagogy with inquiry learning. The targeted population includes non-science major students who are interested in becoming K-8 teachers and are enrolled in an introductory biology course. The paper describes the content and format of the course as offered at the Ohio State University. (YDS)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 472 967

Development of Supplemental Instruction for Pre-Service K-8 Teachers Enrolled in a Non-Major Undergraduate Biology Class: A Golden Opportunity

by
Robert Day
Michael E. Beeth

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

R. Day

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

1

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

BEST COPY AVAILABLE

SE067309

DEVELOPMENT OF SUPPLEMENTAL INSTRUCTION FOR PRE-SERVICE K-8 TEACHERS ENROLLED IN A NON-MAJOR UNDERGRADUATE BIOLOGY CLASS; A GOLDEN OPPORTUNITY.

Robert Day, The Ohio State University
Michael E. Beeth, The Ohio State University

Introduction

In 2001 and 2002, the authors developed a new class for The Ohio State University's College of Education. The class was named "Teaching and Learning Life Science" (OSU designation: "EDU T&L 110"). It was developed in direct response to nationwide calls for the reform of science teacher education. As anyone working in this field is aware, these calls have come from a variety of government and professional organizations, including AETS. They are motivated, in part, by new state and national science content standards, and by current trends towards inquiry learning and "authentic" classroom science. The science content standards set ambitious goals that will require most new teachers, even those teaching at the elementary and middle school levels, to have a reasonable understanding of basic scientific principles and the scientific method. This is a somewhat intimidating prospect for those teachers who have received little formal scientific training. How are these teachers supposed to know anything about "authentic" science if they have never actually been in an authentic scientific laboratory? Our new class attempts to address this issue by combining science content, real lab experience and pedagogy training with actual examples of inquiry learning in action. The class is intended as a companion to The Ohio State University's introductory biology content course for non-science majors (Biology 101). With a quarterly enrolment of more than twelve hundred students, this class is taken by many non-science majors as a way to

SCI7209

fulfill their undergraduate science requirement. "EDU T&L 110" is designed for the subset of "Biology 101" students who are interested in becoming K-8 teachers, but who may be concerned about their level of scientific understanding and their ability to teach science to children in ways that are compatible with the new standards. "Biology 101" seems to be an ideal vehicle for this endeavor because the director of OSU's Introductory Biology Program (IBP), Dr Steve Rissing, wishes to support and expand IBP's pedagogic research and development activities, as well as strengthen its links with Ohio State's College of Education. Dr Rissing has also initiated a policy of introductory biology curriculum reform and subsequently, IBP has updated the content and format of "Biology 101" such that it places a far greater emphasis on inquiry learning. We considered this class a golden opportunity for potential teachers to experience inquiry pedagogy first-hand for themselves. In this paper the authors will describe the format and content of the new class, as well as its strengths and weaknesses as we perceive them.

Learning Objectives of "EDU T&L 110"

- Forge links between content knowledge and modern pedagogic methods for designing, constructing and assessing safe and effective science instruction.
- Prompt students to reflect on the ways that scientific concepts might be taught by drawing on their own learning experiences.
- Familiarize students with national science curriculum standards and examine the implications for teachers working with children of all ages.
- Develop students' understanding of the scientific method and the nature of scientific careers by introducing them to authentic research in laboratories at The Ohio State University.

• Examine issues such as inquiry learning, lab safety, scientific ethics, classroom technology and professional development for new teachers.

• Extend and augment life-science content knowledge and encourage students to embark on a program of life-long learning that will allow them to make sense of contemporary research and find ways to effectively explain it to their students.

• Suggest additional resources that students might use to learn more about science content, science pedagogy, teaching materials, using technology in science lessons and state-mandated standards.

Format and Content of "EDU T&L 110"

"Biology 101" is a quarter long class worth five credit hours. It consists of three hours of lecture, plus one three-hour lab session per week. "EDU T&L" is worth an additional two credit hours and consists of a single one hour and fifteen minute recitation class each week, plus several scheduled field trips. Simultaneous enrolment in "Biology 101" or equivalent is required. To date, "EDU T&L 110" has been offered twice (Winter, 2002, Autumn 2001). The class was co-taught by Day and Beeth in both cases. Development of the class was supported by a University Teacher Education Council P-12 grant from the OSU College of Education. A copy of the Autumn 2002 syllabus can be downloaded in PDF format from:

http://www.angelfire.com/ri/skibizniz/syllabus.pdf

This syllabus includes hyperlinks to all the required class readings. The format of the class is usually as follows; each week "EDU P&L" students meet and discuss the previous week's readings and biology lab activities. Occasionally the instructor may give a brief review lecture of some of the major points from the readings, especially during the

first three weeks. Later in the quarter, students concentrate on preparing, discussing and refining lesson plans, and may practice their lessons by presenting portions for the class. Field trips typically consist of an instructor-chaperoned, forty-minute interactive presentation by a "host" graduate student or faculty member who discusses their research, as well as the organization of their lab and their views on science education. The success of this portion of the class depends on selecting scientist hosts who have a genuine interest in education and a willingness to take time out of their busy day to meet with student teachers. This part of the class requires extensive research and networking on the part of the "EDU T&L" instructor, and usually benefits from a prior professional relationship between the instructor and the host, since some familiarity with the host's research may be needed in order to help translate its technical nuances into language that the non-science major student teachers can understand. "EDU T&L" culminates with an appointment at a local elementary school where student teachers present a short (15 minute) lesson to a class or small group of children. The teaching episode is videotaped so that the student teacher can evaluate their performance. They are also provided with a copy of the videotape for their own records. For many students, this is their first teaching experience and the authors feel that the quality of the students' efforts (as well as their positive feedback) indicate that "EDU T&L 110" has been a useful educational experience for the participants.

An abbreviated summary of "EDU T&L 110" teaching activities is given below. The sequence shown here is approximately equivalent to the actual sequence of events during a typical quarter:

• Review of the scientific method and modern scientific philosophy.

• Review of modern theories of science teaching and learning.

• Review of common web-based science teaching resources.

• Throughout the quarter, students keep a reflective log book as a way to reflect on their learning and record any thoughts or questions that arise during "Biology 101" so that these can then be discussed in "EDU T&L 110".

• Critical discussion of "Biology 101" inquiry pedagogy.

• Clarification of difficult science concepts and content from "Biology 101".

• Visits (between three and five per quarter) to actual biology research labs at The Ohio State University and observation of real research.

• Introduction of students to biology faculty, providing an opportunity to hear their views on research issues, science education trends and science career paths.

• Through these introductions, student teachers hopefully establish lasting professional relationships with education-minded scientists.

• Review of state and national science standards and a discussion of their implementation in grades K-8. Frequent reference to major science standards documents are made throughout the class.

• Review of some practical issues such as lab safety and technology in schools.

• Creation of age appropriate, standards-linked science lesson plans.

• Discuss modern issues in science education with inservice K-8 teachers.

• Teach a short prepared science lesson at a local elementary school.

• Self-evaluation of the video record from the teaching episode mentioned above.

"EDU T&L 110" emphasizes constructivist pedagogy by encouraging students to forge cognitive connections between real scientific research, science content knowledge

and their own activities in the lab sections of "Biology 101". The class also affords an opportunity for students to critique and discuss the content, organization and inquiry-based pedagogy used in both lecture and lab of their introductory biology class. We hope that by facilitating student teachers' metacognitive analyses of their own learning process as non-science majors in a science class, they may be better able to anticipate and respond to their own student's needs when the time comes for them to teach science themselves. Special attention was given to ways that teaching strategies used in a college-level biology class might be adapted to allow effective communication of complicated scientific concepts and cutting-edge research techniques to young children. Strong emphasis was also placed on the importance of the scientific method as it is actually used in real laboratories and on the development of a personal teaching strategy that integrates educational theory, the scientific method and science content standards. The authors decided that the most important standards documents for Ohio student teachers were those produced by the National Science Foundation, The American Association for the Advancement of Science and The Ohio Department of Education. Explicit reference to these organizations and their recommendations was therefore made throughout the class. Potential teachers are thus (hopefully) made aware of current trends within science education and the educational expectations of the State of Ohio well in advance of the commencement of their teaching careers.

Related Efforts at Other Institutions

North (2001) describes the reorganization of Alaska Pacific University's "Integrated Science" course for preservice teachers and non-science majors. Prior to the reorganization, students took four separate science classes over two semesters. Each class

had its own syllabus and the teaching approach consisted of traditional lecture and lab sessions. In the new version of the series, instructors work together using a true "team" approach. Both instructors are present in most sessions and the lecture format has been made more interactive with inquiry exercise, hands-on demonstrations and trivia contests. There is a greater emphasis on contemporary popular science literature and "science for the lay person". NASA's "Mission to planet Earth" materials have been adopted for the Earth systems section and students are encouraged to use these materials to "learn through teaching" by using the materials to develop there own engaging lessons that are then given to children in local public schools.

Dawson and Saunders (1999) describe the reform of a biology class for preservice teachers at Aims Community College. The revised class taught biology content using inquiry and constructivist pedagogy and filtered the content so that it was explicitly connected to K-8 national and state standards. The feedback from the students was generally positive. Many of the students could immediately see the advantage of helping preservice teachers become familiar with the new standards, although a few apparently had a little trouble adapting to the constructivist approach to assessment, claiming that they would be more comfortable with traditional multiple choice exams.

California State University offers a program called "Teaching of Science - Science of Teaching" for preservice and inservice K-12 teachers. This program allows teachers to mix and match a number of different inquiry-based lab classes with classroom pedagogic research in order to extend both their science content knowledge and their understanding of innovative ways to teach this new knowledge.

Evaluation of the Class

Although the students who participated in "EDU T&L 110" provided positive feedback, it is hard to draw any solid conclusions about the usefulness of this class for preservice teacher education because the enrolment was extremely low for both of the quarters in which it was offered. An analysis of this unfortunate situation revealed a fairly obvious demographic reason for this low enrolment that we initially overlooked. There is no undergraduate education major at The Ohio State University; our College of Education only accepts post-graduates into its M.Ed program, and they can only get elective credit for 600 level classes. When we first planned this class we believed, perhaps naively, that in a biology class of more than twelve hundred students, a significant number would already have an interest in K-8 education and would see the value of our companion class. The reality is that virtually none of the "Biology 101" students (who are primarily first and second year undergraduates) have made any decision as to the likelihood of their becoming teachers. When students in the two "Biology 101" lecture sections (about 700 students each) were asked directly to indicate which of them were interested in teaching (in any subject, at any level), virtually none of them showed any interest at all. In a sense we may have "put the cart before the horse" by looking for "Biology 101" students who might want to be "guests" in an education class. What we now believe we should have done (and what we intend to do) is retool the class as an official part of the M.Ed program and offer it as a 5 credit hour, 600 level class that merges "Biology 101" and "EDU T&L 110". Enrolled M.Ed students would be required to become "guests" in the "Biology 101" lab sessions so they can experience inquiry learning first hand. They might also have the option to sit in on the lectures too, the logic being that even though they

may have taken an equivalent non-major class elsewhere at some point, they are more likely to absorb and internalize the material second time around, especially if they are made aware of the importance of the new science content standards in their own teaching. The main drawback to this approach is the fact that we will face some administrative headaches with Ohio State's funding system: Departments receive funds as a function of the number of students they sign up for their classes. Offering a truly interdisciplinary class featuring cooperation between two colleges tends to make the paperwork specifics somewhat difficult, although apparently not impossible. It was a desire to avoid this paperwork headache that initially led us to try the "two separate classes" approach because this strategy required no "untangling" of department funding and had no effect on the expected enrolment of "Biology 101". Only students who would have taken "Biology 101" anyway were likely to enroll in "EDU T&L 110", thereby avoiding complications we might face if our new approach boosts the numbers of students to the point that it "closes out" undergraduates who need "Biology 101" to complete their degrees. Nonetheless, notwithstanding some administrative difficulties that we still need to resolve, we are reasonably confident that this change of strategy will boost enrolment significantly and allow us to contribute more significantly to Ohio State's teacher education program. We offer our experience here partly as a cautionary tale for colleagues who may be thinking of a similar response to calls for teacher education reform. Although an existing, undergraduate, inquiry-based, science class may look like a golden opportunity for teacher education, it will be "an opportunity missed" unless you can actually make the class available to students who already know they want to be teachers. Even if the large size of an undergraduate class makes it statistically likely that

potential teachers are present, they may not yet know who they. This may be especially true if, like The Ohio State University, you have no undergraduate education program to help them make this decision.

References

AAAS (American Association for the Advancement of Science).(1990). *Benchmarks for Science Literacy*. New York: Oxford University Press.

AETS Position statement (undated) *Professional Knowledge Standards for Science Teacher Educators*. Available at: http://aets.chem.pitt.edu/standards.htm

California State University Long Beach (undated). Course description. Available at: http://www.uces.csulb.edu/index.asp?page=catalog&cId=879

Dawson, Carolyn C, Saunders,Gerald W, (1999) *Teaching Biology to Preservice Elementary Teachers: using the k-8 content standards as a framework.* Available at: http://www.ed.psu.edu/CI/Journals/1999AETS/Dawson_Saunders.rtf.

North, Douglas K (2001) *SC 100 - Integrated Science for Pre-Service Teachers and Non-Science Majors.* Available at: nova.ed.uidaho.edu/pdf/project_summaries/1.pdf

NRC (National Research Council). (1996). *National Science Education Standards*. Washington, D.C.: National Academy Press.

Ohio Science Academic Content Standards (2002). Available at: e.state.oh.us/academic_content_standards/acsscience.asp

SE 67209

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

REPRODUCTION RELEASE

(Specific Document)

I. DOCUMENT IDENTIFICATION:

Title: Development of Supplemental Instruction for Preservice K-8 Teachers Enrolled in a non-major Undergraduate Biology Class; a golden opportunity	
Author(s): Day, Robert J., Beeth, Michael E.	
Corporate Source:	Publication Date: 2003

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic media, and sold through the ERIC Document Reproduction Service (EDRS). Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce and disseminate the identified document, please CHECK ONE of the following three options and sign at the bottom of the page.

The sample sticker shown below will be affixed to all Level 1 documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

1

Level 1

☑

Check here for Level 1 release, permitting reproduction and dissemination in microfiche or other ERIC archival media (e.g., electronic) and paper copy.

The sample sticker shown below will be affixed to all Level 2A documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE, AND IN ELECTRONIC MEDIA FOR ERIC COLLECTION SUBSCRIBERS ONLY, HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

2A

Level 2A

☐

Check here for Level 2A release, permitting reproduction and dissemination in microfiche and in electronic media for ERIC archival collection subscribers only

The sample sticker shown below will be affixed to all Level 2B documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

2B

Level 2B

☐

Check here for Level 2B release, permitting reproduction and dissemination in microfiche only

Documents will be processed as indicated provided reproduction quality permits.
If permission to reproduce is granted, but no box is checked, documents will be processed at Level 1.

I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate this document as indicated above. Reproduction from the ERIC microfiche or electronic media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries.

Sign here, → please

Signature: Robert J. Day	Printed Name/Position/Title: Robert Day
Organization/Address: The Ohio State University, College of Education, 1945 N. High St. Cols OH 43210	Telephone: (614) 292-4178 FAX:
	E-Mail Address: day.3@osu.edu Date: 2/05/03

(over)